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EXAMINER	
THOMPSON, JAMES A	
ART UNIT	**PAPER NUMBER**
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/007,440	CROUNSE, KENNETH R.	
	Examiner	Art Unit	
	James A. Thompson	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 December 2001 and 01 April 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 December 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/1/02*.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed 01 April 2002 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. There is no copy of *Digital Halftoning* by Ulichney in the application file. The information disclosure statement has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 3-4 and 12-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 3-4 and 12-13 each recite the limitation "the positive power" in line 1 of each respective claim. There is insufficient antecedent basis for this limitation in the claims.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 5-10, 14-19 and 23-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Shimazaki (US Patent 5,832,122).

Regarding claims 1, 10 and 19: Shimazaki discloses a screening system (figure 1 of Shimazaki) comprising means (figure 1(10,22) of Shimazaki) for generating, retrieving or storing a screen suited for the transformation of a continuous tone image into a halftone image, wherein said screen comprises a plurality of discrete spotlike zones generated by using threshold values in a threshold matrix (figure 5 and column 4, lines 6-10 of Shimazaki), the threshold matrix produced by (a) providing a base supercell suitable for periodically tiling a plane (figure 5 and column 4, lines 46-51 of Shimazaki), the base supercell having a plurality of microdots and a plurality of virtual halftone centers (figure 5(1,2) and column 4, lines 36-41 of Shimazaki); (b) assigning an ordering sequence comprising a series of numbers on the virtual halftone dot centers in the base supercell (column 4, lines 36-45 of Shimazaki) by (i) assigning a first number in the ordering sequence to a first virtual halftone dot center in the base supercell (figure 5(1) and column 4, lines 55-59 of Shimazaki); (ii) assigning a second consecutive number in the ordering sequence to a second virtual halftone dot center in the base supercell (figure 5(2) and column 4, lines 55-59 of Shimazaki); (iii) calculating a value of an aggregate distance function (figure 4(S166) and column 5, lines 9-17 of Shimazaki) for each virtual halftone dot center in the base supercell not already

included in the ordering sequence (figure 3 and column 4, line 60 to column 5, line 3 of Shimazaki); (iv) selecting a next virtual halftone dot center in the base supercell in response to the calculated aggregate distance function, the next virtual halftone dot center having one of the least values of the calculated aggregate distance function (figure 3 and column 4, line 60 to column 5, line 3 of Shimazaki); (v) assigning the next consecutive number in the ordering sequence to the selected next virtual halftone dot center in the base supercell (figure 7; and column 5, lines 61-67 of Shimazaki); and (vi) repeating steps (iii), (iv) and (v), until each virtual halftone dot center in the base supercell is included in the ordering sequence (figure 4 and column 6, lines 1-4 of Shimazaki); (c) assigning threshold values to microdots in response to the ordering sequence thereby generating the threshold matrix in the base supercell (figure 7 and column 6, lines 5-8 of Shimazaki); and (d) using the threshold matrix in combination with the contone image to generate a screened halftone image on the recording medium (column 4, lines 4-13 of Shimazaki).

Regarding claims 5, 14 and 23: Shimazaki discloses that the second virtual halftone dot center (figure 5(2) of Shimazaki) is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center (figure 5(1) of Shimazaki) in any supercells adjacent to the base supercell (figure 5 of Shimazaki). As can be seen from figure 5 of Shimazaki, the second virtual halftone dot center in the base (center) supercell is three blocks to the right and two blocks up from the first virtual halftone dot center, but is three blocks to the right and *three* blocks down from the first virtual halftone dot center of the above adjacent supercell.

Thus, the second virtual halftone dot center is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in the supercells immediately above the base supercell. Furthermore, by similar analysis, said second virtual halftone dot center is clearly disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in all the other supercells adjacent to the base supercell.

Regarding claims 6, 15 and 24: Shimazaki discloses that the distance between the second virtual halftone dot center (figure 5(2) of Shimazaki) and the first virtual halftone dot center (figure 5(1) of Shimazaki) is not equal to the distance between the second virtual halftone dot center and the periodic replication of the first virtual halftone dot center in any supercells directly adjacent to the base supercell (figure 5 of Shimazaki). As can clearly be seen from figure 5 of Shimazaki, the distance between the second virtual halftone dot center and the first virtual halftone dot center in the base (center) supercell is different than the distance between the second virtual halftone dot center in the base supercell and the first virtual halftone dot center in all of the adjacent supercells.

Regarding claims 7, 16 and 25: Shimazaki discloses that the second virtual halftone dot center (figure 5(2) of Shimazaki) is disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center (figure 5 (1) of Shimazaki) in any supercells adjacent to the base supercell (figure 5 of Shimazaki). The periodically replicated supercells shown in figure 5 of Shimazaki are merely exemplary. Using particular differently-sized base supercell in the system taught by Shimazaki will cause the second virtual halftone dot

center to be disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

Regarding claims 8, 17 and 26: Shimazaki discloses that the plurality of virtual halftone dot centers (figure 7(1,2,3A, 3B,23A,23B,24,25) of Shimazaki) in the base supercell is arranged on a periodic grid having a screen angle and a screen ruling (figure 7 of Shimazaki). As can clearly be seen in figure 7 of Shimazaki, the virtual halftone dot centers are set in an evenly-spaced rectangular grid with a screen angle of zero.

Regarding claims 9, 18 and 27: Shimazaki discloses, after step (c) and prior to step (d), the step of rescaling the range of the threshold values according to a range of pixel values within the contone image (column 6, lines 43-49 of Shimazaki).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 2, 11 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Woods (US Patent 6,833,933 B1).

Regarding claims 2, 11 and 20: Shimazaki discloses that the aggregate distance function for each virtual halftone dot

center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence, with each of the distances raised to a positive power (figure 4(S166) and column 4, line 60 to column 5, line 3 of Shimazaki).

Shimazaki does not disclose expressly that said distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence, with each of the distances raised to a positive power.

Woods discloses a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence (column 3, lines 17-27 of Woods), with each of the distances raised to a positive power (column 4, lines 17-20 of Woods). The distance function ($D = \frac{R - D'}{D'}$ where $D' = \sqrt[1.55]{D_{\max}^{1.55} + \min\left(D_{\max} - 0.1D_{\min}, D_{mec}\right)^{1.55}}$ and $R = \sqrt{\frac{30}{\pi\left(\frac{(N/2) - abs(t - (N/2))}{N}\right)}}$) (column 4, lines 7-20 of Woods) is a summation of distances between the candidate point and all existing dots, and is minimized with respect to all existing dots (column 3, lines 8-27 of Woods). The placement of the dots is to be as uniform as possible (column 3, line 25 of Woods), thus the distance function is based on the inverse distance, since a function that is proportional with the inverse distance would have to be minimized to maximize the uniformity of dot distribution.

Shimazaki and Woods are combinable because they are from the same field of endeavor, namely the distribution of threshold

values in halftone screens for halftone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations taught by Woods in the distribution of threshold values, and thus dot orders, in the system of Shimazaki. Thus, said distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence, with each of the distances raised to a positive power. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki to obtain the invention as specified in claims 2, 11 and 20.

8. Claims 3-4, 12-13 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Woods (US Patent 6,833,933 B1) and obvious engineering design choice.

Regarding claims 3, 12 and 21: Shimazaki does not disclose expressly that the positive power is 1.5.

Woods discloses that many possible distance functions can be used (column 4, lines 6-8 of Woods).

Shimazaki and Woods are combinable because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for halftone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations (column 3, lines 17-27 of Woods), raised to a positive power (column 4, lines 17-20 of Woods), wherein said

aggregate function can be one of many possible functions (column 4, lines 6-8 of Woods), as taught by Woods in the distribution of threshold values, and thus dot orders, in the system of Shimazaki. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki.

While Shimazaki in view of Woods does not disclose expressly that the positive power is 1.5, it would have been an obvious engineering design choice to select the positive power as 1.5. A value of 1.5 for the positive power would cause the value of the inverse distance function to dissipate, but not rapidly. Furthermore, 1.5 is close to the value of the power that inverse distance is raised to when determining Coulomb forces, which is relied upon in the placement of toner particles in halftone image transference.

Regarding claims 4, 13 and 22: Shimazaki does not disclose expressly that the positive power is 2.0.

Woods discloses that many possible distance functions can be used (column 4, lines 6-8 of Woods).

Shimazaki and Woods are combinable because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for halftone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations (column 3, lines 17-27 of Woods), raised to a positive power (column 4, lines 17-20 of Woods), wherein said aggregate function can be one of many possible functions (column 4, lines 6-8 of Woods), as taught by Woods in the distribution

of threshold values, and thus dot orders, in the system of Shimazaki. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki.

While Shimazaki in view of Woods does not disclose expressly that the positive power is 2.0, it would have been an obvious engineering design choice to select the positive power as 2.0. A value of 2.0 for the positive power would cause the value of the inverse distance function to dissipate, but not rapidly. Furthermore, 2.0 is the value of the power that the inverse distance is raised to when determining Coulomb forces, which is relied upon in the placement of toner particles in halftone image transference.

9. Claims 28, 37-41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065).

Regarding claim 28: Shimazaki discloses a method for reproducing a contone image as a halftone image on a recording medium, using threshold values in threshold matrices (figure 5 and column 4, lines 6-10 of Shimazaki), comprising the steps of (a) providing a first base supercell suitable for periodically tiling a plane (figure 5 and column 4, lines 46-51 of Shimazaki), the first base supercell having a first plurality of microdots and a first plurality of virtual halftone centers (figure 5(1,2) and column 4, lines 36-41 of Shimazaki); (c) assigning a first ordering sequence in the first base supercell, the first ordering sequence comprising a series of numbers

(column 4, lines 36-45 of Shimazaki) by (i) assigning a first number in the first ordering sequence to a first virtual halftone dot center in the first base supercell (figure 5(1) and column 4, lines 55-59 of Shimazaki); (iii) calculating a value of a combined aggregate distance function (figure 4(S166) and column 5, lines 9-17 of Shimazaki) for each virtual halftone dot center from a first plurality of virtual halftone dot centers (figure 5(1,2) of Shimazaki) in the first base supercell not already included in the first ordering sequence (figure 3 and column 4, line 60 to column 5, line 3 of Shimazaki); (iv) selecting a first next virtual halftone dot center in the first base supercell in response to the value of the combined aggregate distance function calculated in step (iii), the first next virtual halftone dot center having one of the least values of the combined calculated aggregate distance function (figure 3 and column 4, line 60 to column 5, line 3 of Shimazaki); (v) assigning the next consecutive number in the first ordering sequence to the selected first next virtual halftone dot center in the first base supercell (figure 7; and column 5, lines 61-67 of Shimazaki); and (ix) repeating steps (iii), (iv) and (v), until each virtual halftone dot center in the base supercell is included in the ordering sequence (figure 4 and column 6, lines 1-4 of Shimazaki); (d) assigning threshold values to microdots in response to the first ordering sequence thereby generating the first threshold matrix in the first base supercell (figure 7 and column 6, lines 5-8 of Shimazaki); and (f) using the first threshold matrix in combination with the contone image to generate a screened halftone image on the recording medium (column 4, lines 4-13 of Shimazaki).

Shimazaki does not disclose expressly that said halftone image is a multi-color halftone image; (b) providing a second base supercell suitable for periodically tiling a plane, the second base supercell having a second plurality of microdots and a second plurality of virtual halftone dot centers; (c) assigning a second ordering sequence to the virtual halftone dot centers in the second base supercell, the second ordering sequence comprising series of numbers by (ii) assigning a first number in the second ordering sequence to a first virtual halftone dot center in the second base supercell; (vi) calculating a value of a combined aggregate distance function for each virtual halftone dot center from a second plurality of virtual halftone dot centers in the second base supercell not already included in the second ordering sequence; (vii) selecting a second next virtual halftone dot center in the second base supercell in response to the value of the combined aggregate distance function calculated in step (vi), the second next virtual halftone dot center having one of the least values of the combined calculated aggregate distance function; (viii) assigning the next consecutive number in the second ordering sequence to the selected second next virtual halftone dot center in the second base supercell; (ix) repeating steps (vi)-(viii), until each virtual halftone dot center in the second base supercell is included in the second ordering sequence; (e) assigning threshold values to microdots in response to the second ordering sequence thereby generating the second threshold matrix in the second base supercell; and (f) using the second threshold matrix in combination with the contone image to generate a screened multi-color halftone image on the recording medium.

Ulichney discloses processing a plurality of colors, wherein each color is processed separately and independently (column 9, lines 1-8 of Ulichney).

Shimazaki and Ulichney are combinable because they are from the same field of endeavor, namely halftoning and printing continuous-tone image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply the method of Shimazaki to multiple colors, wherein each color is processed separately and independently, as taught by Ulichney. Thus, by applying the method taught by Shimazaki to a second independent color component, the method of Shimazaki in view of Ulichney would further comprise (b) providing a second base supercell suitable for periodically tiling a plane, the second base supercell having a second plurality of microdots and a second plurality of virtual halftone dot centers; (c) assigning a second ordering sequence to the virtual halftone dot centers in the second base supercell, the second ordering sequence comprising series of numbers by (ii) assigning a first number in the second ordering sequence to a first virtual halftone dot center in the second base supercell; (vi) calculating a value of a combined aggregate distance function for each virtual halftone dot center from a second plurality of virtual halftone dot centers in the second base supercell not already included in the second ordering sequence; (vii) selecting a second next virtual halftone dot center in the second base supercell in response to the value of the combined aggregate distance function calculated in step (vi), the second next virtual halftone dot center having one of the least values of the combined calculated aggregate distance function; (viii) assigning the next consecutive number in the second ordering

sequence to the selected second next virtual halftone dot center in the second base supercell; (ix) repeating steps (vi)-(viii), until each virtual halftone dot center in the second base supercell is included in the second ordering sequence; (e) assigning threshold values to microdots in response to the second ordering sequence thereby generating the second threshold matrix in the second base supercell; and (f) using the second threshold matrix in combination with the contone image to generate a screened multi-color halftone image on the recording medium. The suggestion for doing so would have been that the method of Shimazaki is applied to a monochromatic image, but each color component is also processed separately and independently, each color as a monochromatic image (column 9, lines 8-15 of Ulichney). Therefore, it would have been obvious to combine Ulichney with Shimazaki to obtain the invention as specified in claim 28.

Further regarding claim 37: Shimazaki discloses, after step (i) and before step (iii), the step of assigning a second consecutive number in the first ordering sequence to a second virtual halftone dot center (figure 5(2) of Shimazaki) in the first base supercell (column 4, lines 54-59 of Shimazaki); and assigning a second consecutive number in the second ordering sequence to a second virtual halftone dot center (figure 5(2) of Shimazaki) in the second base supercell (column 4, lines 54-59 of Shimazaki). As discussed above in the arguments regarding claim 28, Shimazaki in view of Ulichney teaches multiple color components. Thus, the teachings of Shimazaki are applied separately and independently to each color component.

Further regarding claim 38: Shimazaki discloses that, in each base supercell, the second virtual halftone dot center

(figure 5(2) of Shimazaki) is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center (figure 5(1) of Shimazaki) in any supercells adjacent to the base supercell (figure 5 of Shimazaki). As can be seen from figure 5 of Shimazaki, the second virtual halftone dot center in the base (center) supercell is three blocks to the right and two blocks up from the first virtual halftone dot center, but is three blocks to the right and *three* blocks down from the first virtual halftone dot center of the above adjacent supercell. Thus, the second virtual halftone dot center is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in the supercells immediately above the base supercell. Furthermore, by similar analysis, said second virtual halftone dot center is clearly disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in all the other supercells adjacent to the base supercell.

Regarding claim 39: Shimazaki discloses that, in each supercell, the distance between the second virtual halftone dot center (figure 5(2) of Shimazaki) and the first virtual halftone dot center (figure 5(1) of Shimazaki) is not equal to the distance between the second virtual halftone dot center and the periodic replication of the first virtual halftone dot center in any supercells directly adjacent to the base supercell (figure 5 of Shimazaki). As can clearly be seen from figure 5 of Shimazaki, the distance between the second virtual halftone dot center and the first virtual halftone dot center in the base (center) supercell is different than the distance between the second virtual halftone dot center in the base supercell and the

first virtual halftone dot center in all of the adjacent supercells.

Further regarding claim 40: Shimazaki discloses that, in each base supercell, the second virtual halftone dot center (figure 5(2) of Shimazaki) is disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center (figure 5 (1) of Shimazaki) in any supercells adjacent to the base supercell (figure 5 of Shimazaki). The periodically replicated supercells shown in figure 5 of Shimazaki are merely exemplary. Using particular differently-sized base supercell in the system taught by Shimazaki will cause the second virtual halftone dot center to be disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

Further regarding claim 41: Shimazaki discloses that the first plurality of virtual halftone dot centers (figure 7(1,2, 3A,3B,23A,23B,24,25) of Shimazaki) is arranged on a periodic grid having a first screen angle and a screen ruling (figure 7 of Shimazaki). As can clearly be seen in figure 7 of Shimazaki, the virtual halftone dot centers are set in an evenly-spaced rectangular grid with a screen angle of zero.

Further regarding claim 43: Shimazaki discloses, after step (e), the step of rescaling the range of the threshold values according to a range of pixel values within the contone image (column 6, lines 43-49 of Shimazaki).

10. Claims 29 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065) and Woods (US Patent 6,833,933 B1).

Further regarding claim 29: As discussed in the arguments regarding claim 28, Shimazaki combined with Ulichney teaches a first base supercell and a second base supercell. Shimazaki in view of Ulichney discloses that the first component aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power (figure 4(S166) and column 4, line 60 to column 5, line 3 of Shimazaki); and the second component aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power (figure 4(S166) and column 4, line 60 to column 5, line 3 of Shimazaki).

Shimazaki in view of Ulichney does not disclose expressly that said first component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power; and that said second component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power.

Woods discloses a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence (column 3, lines 17-27 of Woods), with each of the distances raised to a positive power

(column 4, lines 17-20 of Woods). The distance function ($D = \frac{R - D'}{D'}$ where $D' = \sqrt[1.55]{D_{\max}^{1.55} + \min\left(D_{\max} - 0.1D_{\min}, D_{mec}\right)^{1.55}}$ and $R = \sqrt{\frac{30}{\pi\left(\frac{(N/2) - abs(t - (N/2))}{N}\right)}}$) (column 4, lines 7-20 of Woods) is a summation of distances between the candidate point and all existing dots, and is minimized with respect to all existing dots (column 3, lines 8-27 of Woods). The placement of the dots is to be as uniform as possible (column 3, line 25 of Woods), thus the distance function is based on the inverse distance, since a function that is proportional with the inverse distance would have to be minimized to maximize the uniformity of dot distribution.

Shimazaki in view of Ulichney is combinable with Woods because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for halftone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations taught by Woods in the distribution of threshold values, and thus dot orders, in the method of Shimazaki. Thus, said first component aggregate distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power; and that said second component aggregate distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a

positive power. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki to obtain the invention as specified in claim 29.

Further regarding claim 32: As discussed in the arguments regarding claim 28, Shimazaki combined with Ulichney teaches a first base supercell and a second base supercell. Shimazaki in view of Ulichney discloses that the first component aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power (figure 4(S166) and column 4, line 60 to column 5, line 3 of Shimazaki); and the second component aggregate distance function for each virtual halftone dot center comprises the distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power (figure 4(S166) and column 4, line 60 to column 5, line 3 of Shimazaki).

Shimazaki in view of Ulichney does not disclose expressly that said first component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence, with each of the distances raised to a positive power; and that said second component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center

already included in the first ordering sequence, with each of the distances raised to a positive power.

Woods discloses a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence (column 3, lines 17-27 of Woods), with each of the distances raised to a positive power (column 4, lines 17-20 of Woods). The distance function ($D = \frac{R - D'}{D'}$ where $D' = \sqrt[1.55]{D_{\max}^{1.55} + \min\left(D_{\max} - 0.1D_{\min}, D_{mec}\right)^{1.55}}$ and $R = \sqrt{\frac{30}{\pi\left(\frac{(N/2) - abs(t - (N/2))}{N}\right)}}$) (column 4, lines 7-20 of Woods) is a summation of distances between the candidate point and all existing dots, and is minimized with respect to all existing dots (column 3, lines 8-27 of Woods). The placement of the dots is to be as uniform as possible (column 3, line 25 of Woods), thus the distance function is based on the inverse distance, since a function that is proportional with the inverse distance would have to be minimized to maximize the uniformity of dot distribution.

Shimazaki in view of Ulichney is combinable with Woods because they are from the same field of endeavor, namely the distribution of threshold values in halftone screens for halftone printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the aggregate distance calculations taught by Woods in the distribution of threshold values, and thus dot orders, in the method of Shimazaki. Thus, said first component aggregate distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot

center already included in the second ordering sequence, with each of the distances raised to a positive power; and that said second component aggregate distance function would comprise a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence, with each of the distances raised to a positive power. The motivation for doing so would have been to provide a uniform pattern of halftone dots (column 3, lines 25-27 of Woods; and column 6, line 64 to column 7, line 4 of Shimazaki). Therefore, it would have been obvious to combine Woods with Shimazaki to obtain the invention as specified in claim 32.

11. Claims 30-31 and 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065), Woods (US Patent 6,833,933 B1) and obvious engineering design choice.

Further regarding claims 30-31: Woods discloses that many possible distance functions can be used (column 4, lines 6-8 of Woods). It would have been an obvious engineering design choice to select the positive power of the first component aggregate distance function to be less than zero, and particularly 0.5.

Further regarding claims 33-34: Woods discloses that many possible distance functions can be used (column 4, lines 6-8 of Woods). It would have been an obvious engineering design choice to select the positive power of the second component aggregate distance function to be less than zero, and particularly 0.5.

12. Claims 35-36 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view

of Ulichney (US Patent 4,955,065) and Roberts (US Patent 3,742,129).

Further regarding claim 35: Shimazaki in view of Ulichney does not disclose expressly that the first virtual halftone dot center in the second base supercell is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the first base supercell.

Roberts discloses that the halftone screens of the different halftone primary colors are generated at different screen angles (figure 6; and column 4, lines 20-23, lines 27-30 and lines 40-42 of Roberts).

Shimazaki in view of Ulichney is combinable with Roberts because they are from the same field of endeavor, namely halftoning and printing continuous-tone image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to generate the first base supercell and second base supercell at different screen angles and replicate said first base supercell and said second base supercell at different screen angles. Thus, the first virtual halftone dot center in the second base supercell would be disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the first base supercell. The motivation for doing so would have been to reduce printing artifact, such as Moiré, that occur in color halftone printing (column 4, lines 28-34 of Roberts). Therefore, it would have been obvious to combine Roberts with Shimazaki in view of Ulichney to obtain the invention as specified in claim 35.

Further regarding claim 36: The halftone screens of each different halftone color are generated at different angles and the first and second base supercells are replicated at different angles, as discussed in the arguments regarding claim 35. Therefore, the distance between the first virtual halftone dot center in the first base supercell and the first virtual halftone dot in the second base supercell is not equal to the distance between the first virtual halftone dot center in the second base supercell and the periodic replication of the first virtual halftone dot center of the first base supercell in any supercells directly adjacent to the first base supercell.

Further regarding claim 42: Shimazaki in view of Ulichney does not disclose expressly that the second plurality of virtual halftone dot centers is arranged on a periodic grid having a second screen angle and a screen ruling.

Roberts discloses that the halftone screens of the different halftone primary colors are generated at different screen angles (figure 6; and column 4, lines 20-23, lines 27-30 and lines 40-42 of Roberts). Given a regular rectangular grid, the different screen angle taught by Roberts also result in different screen rulings at the respective angles of the different colors.

Shimazaki in view of Ulichney is combinable with Roberts because they are from the same field of endeavor, namely halftoning and printing continuous-tone image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to generate the first base supercell and second base supercell at different screen angles and rulings. Thus, the second plurality of virtual halftone dot centers would be arranged on a periodic grid having a second

screen angle and a screen ruling. The motivation for doing so would have been to reduce printing artifact, such as Moiré, that occur in color halftone printing (column 4, lines 28-34 of Roberts). Therefore, it would have been obvious to combine Roberts with Shimazaki in view of Ulichney to obtain the invention as specified in claim 42.

13. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shimazaki (US Patent 5,832,122) in view of Ulichney (US Patent 4,955,065) and Russell (US Patent Application Publication 2003/0048477 A1).

Regarding claim 44: Shimazaki in view of Ulichney does not disclose expressly that the first plurality of microdots and the second plurality of microdots is the same plurality of microdots.

Russell discloses establishing dots of different types and frequencies in the same halftone screen (figures 4a-4h and paragraph 39 of Russell).

Shimazaki in view of Ulichney is combinable with Russell because they are from the same field of endeavor, namely halftoning and printing continuous-tone image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the multiple halftone screens taught by Shimazaki in view of Ulichney into a single halftone screen, as taught by Russell. The motivation for doing so would have been to provide for smooth tonal transitions (paragraph 10, lines 4-11 of Russell). Therefore, it would have been obvious to combine Russell with Shimazaki in view of Ulichney to obtain the invention as specified in claim 44.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Hiroyuki Morimatsu, US Patent Application Publication 2003/0058482 A1, 27 March 2003, filed 10 May 2001.

b. Yu et al., US Patent 6,433,891 B1, 13 August 2002, filed 14 December 1998

c. Peter William Mitchell Ilbery, US Patent 6,124,844, 26 September 2000.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Thompson whose telephone number is 571-272-7441. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K. Moore can be reached on 571-272-7437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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James A. Thompson
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08 November 2005

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